DOCUMENT RESUME

ED 127 888 HE 008 203

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TITLE Goal Oriented Resource Allocation for University Management. An Administration Paper.
PUB DATE 4 May 76
NOTE 18p.; Paper presented at annual forum of the Association for Institutional Research (10th, Los Angeles, California, May 1976)
AVAILABLE FROM Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Administration; Centralization; Decentralization; Educational Objectives; *Goal Orientation; *Higher Education; *Management by Objectives; *Management Systems; *Resource Allocations; *Systems Approach; Systems Development; Tables (Data)

ABSTRACT

Reported on is an allocation mechanism that combines the decentralized efficiency and incentive features of a market system with the responsiveness of the centralized allocation structure to the overall goals of the university. In this system, decentralized "management centers" are automatically allocated only those income and expense items they can control. "Unearned income" is allocated to the management centers by the central administration to encourage the broad goals of the university. This system has been and will continue to be implemented in stages so that effects can be observed and appropriate corrections or modifications can be made. Three major questions concerning the management center system are addressed: (1) how the system was developed, (2) how the system operates, and (3) what the impact is of introducing the system. (Author)

An Administration Paper

Carnegie-Mellon University

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GOAL ORIENTED RESOURCE ALLOCATION FOR UNIVERSITY MANAGEMENT

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Presented to the Association for Institutional Research Annual Forum

May 4, 1976

Los Angeles, California

Abstract

GOAL ORIENTED RESOURCE ALLOCATION

WITHIN A UNIVERSITY

The allocation of resources within an organization influences how the organization grows or changes. Some universities have adopted a "profit center" concept in which all income and expense are allocated to departments and programs, and each sub-unit must attempt to survive in the resulting market system. In addition to the clear advantages of such systems, there are at least two drawbacks. The central administration, of necessity, must make an arbitrary allocation of "non-controllable" central income and expense items and this allocation will affect the viability of the sub-unit. Second, the sub-units may pursue short range goals in their own self interest that are to the detriment of the university as a whole.

This paper reports on an allocation mechanism that combines the decentralized efficiency and incentive features of a market system with the responsiveness of the centralized allocation structure to the overall goals of the university. In this system, decentralized "management centers" are automatically allocated only those income and expense items that they can control. "Unearned income" is allocated to the management centers by the central administration to encourage the broad goals of the university. This system has been and will continue to be implemented in stages so that effects can be observed and appropriate corrections or modifications can be made.

The paper addresses three major questions concerning the management center system: 1) how the system was developed; 2) how the system operates; and 3) what is the impact of introducing the system.

While managers plan for the future in many ways, the allocation of resources largely determines how an organization grows and changes. Resource allocation is the means by which an organizational plan is implemented. An organization may engage in excellent traditional planning, defining missions and developing strategies and yet fail to benefit if resource allocations do not reflect and support the plan. Alternatively, appropriate resource allocation may provide an effective substitute for traditional planning. In brief, resource allocation plays a key role in a planning process that effectively moves an organization to achieve its objectives.

A variety of processes exist for resource allocation. In a highly centralized allocation process, the president unilaterally may set allocations for subunits or even for individuals. In a highly decentralized system, each faculty member might keep the income he or she generates and pay an overhead charge for services received from the university. Both of these extremes do occur, but common practice lies in between. One premise of this work is that both the process by which resource allocation decisions are made and the decisions themselves are important. Alternate resource allocation processes will influence the behavior of the administrators, deans and department heads by giving them incentives at the margin even when the total numbers undergo little change. The focus of our interest is within private universities, but the general principles apply to public universities and other not-for-profit organizations.

Centralized Resource Allocation

Many colleges and universities utilize a centralized resource allocation structure. In a centralized system, resources are collected at a central level and allocations are made to various subunits by the central administration. Centralized systems typically involve a bargaining process in which the deans or department heads negotiate with the president or chief administrators of the university for their allotment from the central sources of income. These negotiations can depend upon both objective and subjective criteria involving present or past performance and the perceived goals of the allocaters.

Most universities continue to rely on a centralized resource allocation system for significant reasons. First there are inherent problems in defining organizational goals and measurable objectives, especially in a nonprofit organization. The resources that are allocated to each area of the university reflect the implicit evaluation of the objectives and performance for the area. Because these evaluations are implicit and subjective, one can argue that the decisions are best made centrally. Second, universities need to maintain the flexibility to adapt to a changing world. As priorities for education change, the university must be able to reallocate its resources to maintain a viable position. Again, one can argue that such decisions are best made centrally. Third, incomes from such sources as endowment and gifts often lack any natural identification with a subunit, in contrast to tuition and research overhead. Thus it seems reasonable to allocate them centrally. The administration can decide that each subunit will have its own endowment and fund raising program, but such a move seriously impairs the earlier discussed ability to reallocate to meet changing conditions or to enhance the objectives of the central administration.

Decentralized Systems

Some universities operate on a "profit center" or decentralized resource allocation system. In a decentralized system, each profit center -- school or department -- "earns" income directly. This income is used by the unit to pay its own direct operating expenses and to purchase services from other areas of the university. Administrative expenses are generally recovered through a series of overhead charges or taxes on each subunit. These overhead charges may be based on such measures of scale as the number of faculty, students, square feet of space or simply the amount of direct expenditures.

The benefits of decentralized operation generally lie in two areas. The first is a more informed and therefore more adaptive management structure. Since a decentralized resource allocation system allows decisions to be made at lower levels in the organization, managers typically make decisions with more information and with more immediate feedback from the system they are managing. The second advantage of decentralized resource allocation is the ability to provide more direct incentives for subunits. A decentralized system implies some systematic allocation of resources from the central system to the subunits. With an explicit process based on a set of quantifiable performance measures, subunits can expect to receive an increase in their available resources if they perform better. Thus, an active incentive exists for subunit managers to increase their income or to use their current resources more efficiently. Similiar incentives may exist in centralized systems; however, better performance may not result in more resources and cost savings may remain with the central administration.

Management Center System

The system of resource allocation designed for Carnegie-Mellon University (CMU) combines aspects of centralized and decentralized processes. The intent is to achieve the advantages of both while avoiding the disadvantages. The goals of the CMU management center system are defined as follows:

Elements of Decentralization:

1. To provide direct incentives for colleges (at CMU the six main subunits are called colleges) to increase productivity -- i.e., to teach more, to attract and service more students and to seek more research funding.

2. To provide incentives for the colleges to make more efficient use of u iversity resources -- most notably, space and computing.

3. To encourage external fund raising by the colleges themselves.

Elements of Centralization:

4. To maintain sufficient central control to allow the president to determine the overall direction and priorities of the university.

5. To maintain a sense of unity and common purpose in the university -- i.e., to encourage inter-departmental and inter-college efforts to take effective advantage of the strengths of the university as a whole.

The essential characteristic of the management center system is the balance between a collection of independently motivated colleges and a centrally guided university. Note that the "centers" are not expected to recover their full operating costs; and, the system is not intended to be a complete substitute for subjective judgment in determing the relative merit, quality or importance of the academic components of the university. Because of the incentive features are incorporated "at the margin," the larger questions of long-run viability and contribution to the university are reserved for the judgment of the university administrators. The system provides incentives for the colleges while preserving the ability of the university to respond to change and to follow the subjective judgment of the decision makers.

In order to achieve these goals, the system requires strategies for each area of contention in the resource allocation process. Specifically, these strategies define rules for allocating income and charges and for handling surpluses and deficits.

Income Strategies

1. Allocate a portion of the tuition income to the colleges on the basis of the amount of teaching done.

2. Allocate a portion of the tuition income to the colleges on the basis of the number of full-time equivalent majors in the college.

3. Allocate all research overhead income to the colleges (net of any university indirect cost sharing).

The tuition allocations recognize and reward the contributions made by both departments with attractive majors and departments that offer attractive courses. The same tuition rate is used for all colleges, primarily for two reasons. First, the process of differentiating tuition on the basis of different costs relies on history rather than normative information. The state of higher education management is such that no one knows what the average or marginal costs of any particular degree program should be. We only know what it is or was with little real measurement of the relationship between cost and quality. A laboratory dominated program such as chemistry reasonably might cost more per student than an equipment free program such as history; however, no one knows how much more it "should" cost or how much more it is worth per student credit hour. Second, CMU charges a single tuition rate to all undergraduates. Therefore, a system of non-differentiated tuition allocations to the colleges mirrors the university position that the differences in costs are centrally subsidized.

A strategy of allocating all the research overhead recovered (net of cost sharing) encourages the colleges to increase their overhead and to reduce their cost sharing agreements. The current arrangement provides only vague incentives -- i.e., the central administration may or may not reward colleges for net increases in research overhead recovered.

The allocation of restricted endowment and gift income at CMU is highly constrained. Only a limited set of such specifically restricted income as endowed professorships and certain capital grants are allocated automatically. The bulk of the endowment and gift income is retained centrally and is used to provide the president with funds for differential support of colleges and programs.

Cost Allocation Strategies

1. Directly charge the colleges only for those administrative services over which they have control of usage. In the current CMU environment, only space and computing costs meet this criteria.

2. Tax only related income for other administrative services; e.g., student services is supported by a tax on tuition and research contracts, research contract administration by a tax on research income.

As stated earlier, the goal of the charges is to provide incentives; the charges are not designed to recover all of the central administrative costs. Incentives for efficiency operate well only when there is direct control by the consumer over the amount of service demanded and thus charged. Taxes on research and restricted income reflect costs incurred by the central administration and enable the total allocation system to achieve the proper balance of decentralized and centralized allocations. One must be careful to insure that "income tax" rates do not result in marginal income being less than marginal cost. Otherwise, taxes should not seriously impair the incentive structure.

Surplus and Deficit Strategies

1. Structure the allocation system to require an "additional allocation" from the administration to each college. This allocation should not exceed 50 percent of the "earned income net of charges" for each center.

2. Fix the additional allocation early in the year so that the actual performance of the center on the income and expense related variables determines its final position.

3. Allow colleges to accumulate reserves by retaining a portion of any year-end surpluses.

4. Require colleges to repay year-end deficits.

The essential balance of the management center system is obtained by having the central administration make an additional allocation or subvention to the academic units. This allocation is the means by which the university-wide goals are accomplished. It is important for the university allocation to be fixed early in the budget process so that incentive structures can operate. The essence of the "profit center" aspect of the system is obtained by having the schools directly benefit from year-end surpluses and be responsible for repaying year-end deficits. The process by which the university allocations are changed from year to year and the ability of the colleges to retain surpluses and repay deficits are the keys to success or failure of the management center resource allocation system. This area will require additional discussion with the deans, provosts and president, but we feel a fruitful and acceptable solution can be found.

Table 1 contrasts centralized, decentralized and management center allocation center processes for a hypothetical university. In a typical decentralized system, only income on short-term investments is retained centrally. The allocations from the administration to the colleges in a centralized system are generally based on informal, subjective criteria, whereas the administrative charge paid by the colleges to the administration in a decentralized system is usually based on a formula or rate structure. In the management center system, the charges to the colleges are netted out of the income items or the allocations and are not shown explicitly. A fuller accounting of the management center system could show these separately.

TABLE 1

PROTOTYPICAL EXAMPLES OF RESOURCE ALLOCATION SYSTEMS

Centralized Resource Allocation

	University Administration	College A	College B	College C	Total
Income:					
Tuition	10,000	-	-	-	10,000
Endowment	5,200	-	-	-	5,200
Gifts	1,500	-	-	-	1,500
Research Overhead	3,000	-	-	-	3,000
Investment	300	-	-	-	300
TOTAL	20,000	-	-	-	20,000
Allocations:	(14,000)	6,000	4,500	3,500	0
Expenditures:	6,000	6,000	4,500	3,500	20,000
Balance:	0	0	0	0	0

Decentralized Resource Allocation

	University Administration	College A	College B	College C	Total
Income:					
Tuition	-	4,000	3,500	2,500	10,000
Endowment	-	2,700	1,200	1,300	5,200
Gifts	-	650	500	350	1,500
Research Overhead	-	1,700	1,200	100	3,000
Investment	300	-	-	-	300
TOTAL	300	9,050	6,400	4,250	20,000
Charges:	5,700	(3,050)	(1,900)	(750)	0
Expenditures:	6,000	6,000	4,500	3,500	20,000
Balance:	0	0	0	0	0

Management Center Resource Allocation

	University Administration	College A	College B	College C	Total
Income:					
Tuition	4,000	2,500	2,000	1,500	10,000
Endowment	4,200	500	200	300	5,200
Gifts	800	300	250	150	1,500
Research Overhead	500	1,400	1,000	100	3,000
Investment	300	-	-	-	300
TOTAL	9,800	4,700	3,450	2,050	20,000
Allocations:	(2,800)	1,300	1,050	1,450	0
Expenditures:	6,000	6,000	4,500	3,500	20,000
Balance:	0	0	0	0	0

Allocation Rates

The actual calibration of a system involves determing specific rates or "prices" for allocating income and expenses. One starting point is to examine the existing "implicit" rates. A simple linear regression model was used to study the relationship at CMU between the variables used as measures of performance -- teaching units, majors, research support -- and previous budget allocations. These regression models accounted for 60 to 70 percent of the variance in departmental budget allocations at CMU.

With the help of the regression results, calculations were made to determine rates that result in "sufficient" tuition income to the colleges and still allow the central administration to cover the costs of student services including libraries and undergraduate financial aid from centrally retained tuition revenues. Appropriate rates for 1973-4 are those shown in Table 2. The tuition rates allocate approximately 70 percent of the undergraduate tuition and 80 percent of the graduate tuition to the colleges. The per-unit rate is one-half of the actual tuition rate.

The $1 per square foot space charge is intended to represent the marginal cost of using space custodial and utility costs. The marginal cost is used because the total supply of space (buildings) is fixed. Therefore, the controllable cost is really the marginal cost. The colleges have the freedom to exchange space for other services and the university can expect to recover the "marginal cost" of any unused space. The cost of structural improvements, modifications and maintenance are budgeted and controlled centrally. The air conditioning charge represents full average cost because the supply of air conditioned space is not fixed. Many older buildings are not centrally air conditioned. If departments request new air conditioning, the university will recover the full cost of such additions. The research administration tax is designed to recover the costs of the university's research contracts and restricted fund administration.

TABLE 2

MANAGEMENT CENTER BUDGET ALLOCATION RATES - 1973-74

	Income to Colleges
Tuition	$500/FTE Undergraduate $800/FTE Graduate $15/ Unit Taught
Research	100% Overhead Recovered (Net of Indirect Cost Sharing)
Subsidy	Negotiated
	Charges to Colleges
Space	$1 Per Square Foot Per Year
Air Conditioning	$.75 Per Square Foot Per Year
Research & Restricted Fund Administration	5% of Total Direct Costs
Computing	Academic Computing as Billed

Results

Applying the rates in Table 2 to the operation of Carnegie-Mellon University in 1973-74 results in directly allocating approximately 75 percent of the four undergraduate college budgets, requiring an additional 25 percent allocation from the central administration. (Charges for computing were excluded from these calculations.) The School of Humanities requires the smallest allocation -- 18 percent -- and the School of Sciences the largest -- 31 percent.

Some of the principles of the management center system have been introduced independently into the traditional budgeting process at CMU. For example, graduate student tuition scholarships have traditionally been a budget problem. Because the tuition was "earned" centrally, there were many requests for budget adjustment to accommodate the "expense" of tuition scholarships in the colleges. Last year colleges received targets for graduate tuition based on the net revenue received in previous years. Any graduate tuition received from students in a college in excess of the target was divided with 80 percent returned to the colleges for their use in the current year or in the future. This system has the advantage of eliminating the need for negotiations about graduate student support -- any additional costs are borne by the college from their additional income or from other income such as research -- and of recognizing that there is some nonnegative marginal cost to the university of having an additional student on campus. Interestingly enough, graduate student tuition income was significantly higher last year than the year before and the colleges managed to save some of their 80 percent share of the excess for purposes other than graduate student support! Incentive systems do work.

Future

We intend to implement a management center system for the 1977-78 budget cycle. There are still several significant questions that need to be resolved before the system can be tried more fully. First, the president and provosts are concerned that such a system interferes unduly with their influence over quality and content of programs. Most significantly, they are concerned about their ability to compensate for changes in the income structure during the year. For instance, under the current system, if unrestricted giving income is less than expected and other sources such as research overhead are more, the university's position is unchanged. However, under a management center system, the surplus in research overhead is allocated to the colleges automatically, even though the central administration faces a shortfall in unrestricted giving. One solution is to identify the sources of income that make up the central subsidy and to pass through any shortages that occur. Another and perhaps better alternative is to maintain a central reserve. This problem deserves additional study.

A second major question concerns the determination of subsidies. Because the subsidy can vary from year to year the college deans are concerned that it might be reduced to remove the effect of a surplus retained in the previous year. Thus, they argue, there is no real incentive to accumulate surpluses, if they only result in smaller future allocations. Obviously this effect will occur to some extent. The university must find a way to moderate this effect which satisfies both the president and the deans, such as limiting the percentage by which the subsidy can be decreased from one year to the next. A graduated "income tax" on surpluses also has been proposed as a way of limiting accumulation of wealth in one area of the university.

The emphasis throughout this paper concerns the need to achieve a balance between college incentives and university goals in the resource allocation process. All of the parties see real advantages to a management center system if it can be structured in an appropriate way. Clearly, the most significant general result of a move away from a purely centralized system is more involvement of the campus community in the decision making process and more awareness of the basis on which sometimes painful decisions are made.

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